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Medikament und sein Träger

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## Description

This invention relates to the combination of an oral medicament and a support therefor, and more particularly to a means for securing a medicament to a support which facilitates sucking on the medicament while preventing the medicament from breaking off from the support in its entirety or in large pieces which could cause choking, and further to a support which provides protection against accidental swallowing.

There are several types of common medicaments which are intended to be sucked or dissolved slowly in the mouth rather than swallowed whole like a pill. Such medicaments include cough drops, throat lozenges, and the like. However, such forms of medication may be unsuitable for small children or older patients, as large pieces of the medication might dissolve free and become lodged in the throat, causing choking. Additionally, the medication could accidentally be swallowed whole, causing choking or blockage of the throat cavity.

A solution to this problem is to supply the medication in the form of a lollipop or sucker in which the body of the medicament is secured to the end of a stick to facilitate sucking or chewing on the medication. If the medicament is not adequately secured to the stick, it may become separated from the stick and swallowed whole. A danger also exists in that if the user were in a reclined position while holding the stick, the stick could become lodged in the throat.

Several attempts have been made to overcome these problems. For example, Snell, U.S. Patent No. 1,847,415, relates to a holder for candy suckers in which a guard at the upper end is embedded in the candy. The support for the candy comprises a flexible, bendable wire so that if the user would happen to fall while sucking on the stick, the flexible support would prevent the stick from becoming lodged in the throat. However, large pieces of the candy may still be able to break off from the wire and could become lodged in the throat.

Cornfield U.S. Patent No. 2,857,908 describes a tongue depressor which is coated with a candied confection. The depressor is shown to contain three holes in its upper portion where the candy is secured to the depressor. However, there are still large areas where the candy remains unsecured and could become free of the depressor. The holes are only effective if both sides of the medication remain and work as a unit. For example, if the lower portion were to dissolve first, the upper portion would be able to break off. Further, there is no safety feature on the stick which would prevent the stick from becoming lodged in the throat.

Harris et al, U.S. Patent No. 4,551,329 describes an oral medicament in a lollipop shape which is supported on a handle comprising a stick of resilient material looped into a single coil with spring arms extending into enlarged ears on which the medicament is moulded. The handle is designed such that if the medicament becomes separated from the ears, the released spring

arms will spring apart to block entry of the handle into the throat. However, there is a possibility that large pieces of the medicament could break off from the stick which would block entry of the handle into the throat while the medicament is secured to the stick.

U.S. Patent No. 3,943,928 to Lariccia et al. discloses a structure for administering a medication orally in which a medicament is supported on a rod having indentations, embossments, depressions and grooves for the purpose of maintaining the medicament thereon. This structure suffers from the disadvantage that it does not prevent large pieces of the medicament from becoming detached from the support in the event of fracturing caused by a patient biting down on the medicament, or as a result of one side of the medicament being dissolved away in the oral cavity at a greater rate than the other.

Accordingly, there remains a need in the art for an oral medicament which may be administered on a support without the problem of the medication breaking off in its entirety or in large pieces, and further prevents the support from becoming lodged in the throat.

The present invention meets that need by providing a means for securing an oral medicament to a support which allows sucking of the medicament while preventing inadvertent swallowing of the medicament in its entirety or in large pieces, as well as preventing accidental swallowing of the support.

According to the present invention, there is provided a device for oral administration of solid medicament, comprising an elongated support having first and second ends, a solid medicament and means for securing said medicament to one end of said support so that said medicament substantially covers said end of said support, said securing means including means for forming multiple interlocking bonds between said support and said medicament, characterised in that said means for forming multiple interlocking bonds includes a frame on said one end of said support having a plurality of orifices therein to prevent separation of said medicament from said support and to prevent the breakage of large pieces of said medicament from said support during oral administration thereof.

In one embodiment of the invention, the means for securing the medicament to the support comprises a plurality of bristles extending radially outward from the first end of the support. Preferably, the medicament is formed around the bristles such that the medicament substantially covers the end of the support.

In one embodiment of the invention, the securing means comprises a plurality of flattened discs spaced along the first end of the support, wherein each of the discs have a plurality of orifices therein to form interlocking bonds with the medicament. Preferably, the discs are generally circular and may vary in diameter.

In another embodiment of the invention, the securing means comprises a series of curved rib elements spaced around the first end of the support such that the spaces between the ribs permit the formation of inter-

locking bonds between the ribs and the medicament.

In still another embodiment of the invention, the securing means comprises a spiral-threaded element formed around the first end of the support, the threads forming interlocking bonds with the medicament. The threads may have orifices therein to enhance the bonding of the medicament to the support. The threads also control the degree to which the medicament is dissolved.

In a preferred process of the invention, the medicament in liquid form may be poured in and around the securing means and solidified to substantially cover the securing means as well as the end of the support. Thus, the medicament forms interlocking bonds with the securing means and is held securely to the support, preventing the medicament from breaking off in its entirety and preventing large pieces from breaking off. The medicament will be slowly dissolved in the mouth of the user.

Optionally, the support includes a detachable safety guard for preventing inadvertent swallowing of the support. The safety guard comprises a member having a slit therein for slidable attachment to the support. The support includes an interlocking means for securing the safety guard. In one embodiment of the invention, the slit on the safety guard includes a pair of opposing tabs which flex in only one direction, and the securing means on the support comprises a conical element adjacent a shield. The tabs on the safety guard are adapted to flex and permit the safety guard to slide over the conical element and lock into position against the shield. Alternatively, the securing means on the support comprises a flexible conical element adjacent a shield, and the safety guard is adapted to slide over the flexible conical element, temporarily collapsing it, and lock into position against the shield.

In a further embodiment of the invention, the support comprises a generally flat stick having a first end and a second end having a rounded edge, the first end including a generally flat disc including at least one raised area attached thereto. The medicament, in a disc-shaped form, may be secured to the front and/or back sides of the disc through indentations on the surface of the medicament which mate with the raised area on the disc. In a preferred form of the invention, the raised area is a rib or ring. The medicament may be secured to the disc by bonding or gluing using a food grade adhesive. The support may also include a notched edge for securing a safety guard as well as a hole on its lower portion to provide a means for grasping the support in the event of an accident.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings, in which:

Fig. 1 is a top plan view of a medicament on a support in accordance with one embodiment of the present invention;

Fig. 2 is a side view of the medicament on the sup-

port of Fig. 1;

Fig. 3 is a plan view of the safety guard of the present invention;

Fig. 4 is a side view of the safety guard;

Fig. 5 is a perspective view of the medicament on the support illustrating the use of the safety guard; Fig. 6 is a top plan view of another embodiment of the invention;

Fig. 7 illustrates a side view of the solid medicament secured to the circular frame of Fig. 6;

Fig. 8 is a sectional view of the circular frame taken along line 8-8 in Fig. 6;

Fig. 9 is a top plan view of another embodiment of the invention;

Fig. 10 is a partial side view taken along line 10-10 in Fig. 9;

Fig. 11 is a partial perspective of the embodiment of Figs. 9 and 10 and illustrates placement and mating of the medicament with raised areas on the disc;

Fig. 12 is a top plan view of a medicament on a support illustrating the interlocking means on the support;

Fig. 13 is a side view of the embodiment shown in Fig. 12;

Fig. 14 is a plan view illustrating another embodiment of the safety guard;

Fig. 15 is a side view of the safety guard of Fig. 14;

Fig. 16 is a perspective view of the medicament on the support illustrating installation of the safety guard;

Fig. 17 is a sectional view taken along line 17-17 in Fig. 12 showing the collapsible conical interlocking element;

Fig. 18 is a partial side view of another embodiment of the invention utilizing radially extending bristles;

Fig. 19 is an end view of the securing means shown in Fig. 18;

Fig. 20 is a perspective view of the securing means of Fig. 18 attached to the support;

Fig. 21 is a partial top plan view of another embodiment of the invention;

Fig. 22 is a side view of the securing means shown in Fig. 21;

Fig. 23 is an end view of the securing means;

Fig. 24 is a partial perspective view of the securing means of Figs. 21-23 attached to the support;

Fig. 25 is a plan view illustrating another embodiment of the invention in which the interlocking means on the support comprise curved ribs;

Fig. 26 is an end plan view illustrating the embodiment shown in Fig. 25;

Fig. 27 is a plan view illustrating another embodiment of the invention;

Fig. 28 is a perspective view of the medicament on the support illustrating installation of the safety guard having flexible tabs;

Fig. 29 is a sectional view of the solid conical interlocking element taken along line 29-29 in Fig. 28; and

Fig. 30 is a plan view illustrating the safety guard shown in Fig. 28;

Reference is made to Fig. 1 of the drawings which illustrates the oral medicament secured to a support. In accordance with the present invention, an elongated support 10 is provided which includes means for securing a solid medicament 12 thereto. In this embodiment, the support comprises a generally flat stick having a first end and a second end having a rounded edge. The support preferably comprises a flexible plastic material and can be molded as a unitary structure using techniques known in the art.

The support 10 also optionally includes notched edge 18 for securing the removable safety guard shown in Fig. 3. The second end of the support also includes a hole 20 for the purpose of providing a means for grasping or hooking onto the support in the event of an accidental swallowing.

In the embodiment shown in Figs. 1 and 2, the medicament 12 is attached to the support 10 by a flattened spherical frame 14 which is attached to the support. Preferably, the frame and support both comprise a flexible plastic material which can be molded as a unitary structure. The flattened spherical frame comprises a cavity 15 and a plurality of crosshatched holes 16 on the surface thereof. The medicament may be poured in a liquid state through the holes of the frame and solidified in a mold or by other means so as to completely fill the cavity and cover the frame. This is illustrated in the side view of the support shown in Fig. 2. The spherical frame and holes act to form multiple interlocking bonds with the medicament, thus preventing separation of the medicament from the support as well as preventing breakage (through the dissolving process) of any large pieces away from the support. For example, if the lower portion of the medicament were to dissolve first, the upper portion would remain secured due to a core of the medicament (formed within spherical frame 14) remaining within cavity 15.

Figures 3 and 4 illustrate the optional safety guard 22 which may be slidably attached to support 10 in order to provide a protective means which prevents the support from being forced into the user's throat. The safety guard comprises a generally round plate 22 with a slit 24 in its middle portion. As illustrated in Fig. 5, the safety guard may be mounted on the support 10 by slidably attaching it to notched edge 18 of the support where it becomes locked into place. Guard 22 may also be fabricated of a flexible plastic material.

Another embodiment of the invention is illustrated in Fig. 6 in which the support comprises a generally flat stick having a first end and a second end having a rounded edge. The support 10 is turned at an angle, preferably a right angle as illustrated, at its middle portion to prevent the support from being accidentally swallowed or forced down the throat of a user. A generally circular frame 26 is attached to the support on its first end and includes a plurality of raised pedestals 28

attached to the frame into which the liquid medicament may be poured and solidified. The support also includes a hole 20 on its lower portion to provide a means for grasping the support in the event of accidental swallowing. As will be appreciated, this angled support may be used with any of the other embodiments of the invention. Additionally, the angle may also be formed by bending the support. This may be facilitated by providing a weakened area or notched area across the width of the support so that the support will bend along that line. Further, locking means may be provided to lock the support in an angled position. The locking means may comprise, for example, a pair of interlocking tabs or ribs on the support.

Figure 8 illustrates a sectional side view of the circular frame 26. As can be seen, the raised circular pedestals 28 create a cavity 32 into which the medicament may be poured. As shown in Fig. 7, the frame becomes completely coated with the solid medicament, thus forming multiple interlocking bonds which prevent separation of the medicament from the support as well as preventing breakage of any large pieces away from the support.

Figures 9 through 11 illustrate yet another embodiment of the invention in which the support comprises a generally flat stick 10 as described above. Attached to the stick is a generally flat disc 34 with raised areas 35 which serve as a means for securing the medicament to the disc. As shown, these raised areas 35 may take the form of raised rings or ribs. The medicament may take the form of discs or lozenges 12, each preferably having the same diameter as the flat disc 34 and with matching indentations as the raised areas 35. The medicament discs may be secured to disc 34 with the use of a food-grade glue or other adhesive applied only the portion of medicament disc 12 making contact with disc 34. This prevents the user from dissolving the medicament to within the area of the applied glue.

Figures 12 and 13 illustrate another embodiment of the invention in which the medicament 12 is secured to the support 36 which includes interlocking means for securing a safety guard comprising a flexible conical element 37 and a generally circular shield 39. In this embodiment, support 36 is shown as having a generally circular cross section. The safety guard is attached to the support by sliding it over the conical element which flexes and temporarily collapses to permit the safety guard to slide over it. The shield 39 then acts to lock the safety guard into place, and the conical element regains its original shape.

Figures 14 and 15 illustrate one form of the detachable safety guard 40 having a slit 41 in its center portion and also having an optional handle portion 42 attached to opposing sides of the guard. As illustrated in Fig. 16, the safety guard may be mounted onto support 36 by sliding it over conical element 37 and locking it into position against shield 39.

Figs. 28-30 show an alternate construction for safety guard 40 and conical element 37'. As shown in

Figure 30, the slit 41 on the safety guard 40 may include a pair of opposing tabs 49. The tabs on the safety guard are adapted to flex in only one direction and permit the safety guard to slide over a solid conical element 37' and lock into position against shield 39 of the support as shown in Fig. 28.

Figure 28 also illustrates another embodiment of the interlocking means for the medicament as used in the present invention. As shown, medicament 12 (shown in phantom) is secured to a hollow circular frame 14' which has a plurality of ribs 13 spanning the frame. As in the Fig. 1 embodiment, the frame 14' includes a cavity 15 with orifices 16 between the ribs 13.

Figures 18-20 illustrate another embodiment of the invention in which the means for securing the medicament comprises a plurality of bristles 43 extending radially outward from the first end of the support. The bristles may be formed from a thermoplastic material. Preferably, the medicament 12 is poured in liquid form around the bristles such that the medicament substantially covers the end of the support. After solidification, the bristles 43 form multiple interlocking bonds with the medicament and serve to control the degree to which the medicament can be dissolved by the user.

Figures 25 and 26 illustrate another embodiment of the invention in which the securing means comprises a series of curved rib elements 56 spaced around the first end of the support which form interlocking bonds with the medicament. The curved ribs also act to control the degree to which the medicament can be dissolved.

Figure 27 illustrates another embodiment in which the securing means comprises a threaded spiral element 58 formed around the first end of the support, the threads of which form interlocking bonds with the medicament and control the degree to which the medicament can be dissolved. Spiral element 58 may have orifices 59 therein to enhance the bonding of the medicament to the support.

Figures 21-24 illustrate yet another embodiment of the invention wherein the securing means comprises a plurality of generally circular flattened disks 45 spaced along the first end of the support. As shown in Figs. 23 and 24, each of the disks include a plurality of orifices 46 which form interlocking bonds with the medicament. These disks also control the degree to which the medicament can be dissolved.

It will be apparent to those skilled in the art that several different combinations of the above embodiments are possible to produce the desired features previously described.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention as defined in the appended claims.

### Claims

1. A device for oral administration of solid medicament, comprising:

(a) an elongated support (36) having first and second ends;  
 (b) a solid medicament (12); and  
 (c) means for securing said medicament to one end of said support so that said medicament (12) substantially covers said end of said support (36), said securing means including means for forming multiple interlocking bonds between said support (36) and said medicament, characterised in that said means for forming multiple interlocking bonds includes a frame on said one end of said support (36) having a plurality of orifices (16) therein to prevent separation of said medicament (12) from said support (36) and to prevent the breakage of large pieces of said medicament from said support during oral administration thereof.

2. A device as claimed in claim 1, wherein said frame (14') includes at least one cavity (15) therein, the plurality of orifices (16) in the surface thereof communicating with said cavity (15) for securing said medicament (12) to said support (36).
3. A device as claimed in claim 1, wherein said frame comprises a plurality of flattened disks (45) spaced along said one end of said support (10), the plurality of orifices (46) therein to form said interlocking bonds with said medicament (12).
4. A device as claimed in claim 1, wherein said frame comprises a series of curved rib elements (56) spaced around said one end of said support (36) such that said curved rib elements define said plurality of orifices to form said interlocking bonds with said medicament (12).
5. A device as claimed in claim 1, wherein said frame comprises a spiral-threaded element (58) formed around said one end of said support (36), said spiral threaded element including a plurality of orifices (59) therein to form said interlocking bonds with said medicament (12).
6. A device as claimed in claim 1, further comprising a detachable safety guard (40) for preventing inadvertent swallowing of said support (36) comprising a member having a slit (41) therein for slidable attachment to said support and means on said support for slidably securing said safety guard thereto comprising means (37, 39) for interlocking with said slit.
7. A device as claimed in claim 6, wherein said slit includes a pair of opposing tabs (49) which flex in only one direction.
8. A device as claimed in claim 6, wherein said interlocking means on said support comprises a conical

element (37') adjacent a shield (39), said tabs on said safety guard (40) adapted to flex and permit said safety guard to slide over said conical element (37') and lock into position against said shield (39).

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9. A device as claimed in claim 6, wherein said interlocking means on said support comprise a flexible conical element (37) adjacent a shield (39), said safety guard (40) adapted to slide over said conical element (37) and lock into position against said shield (39).

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**Patentansprüche**

1. Vorrichtung zur oralen Verabreichung eines festen Medikamentes, umfassend:

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a) einen länglichen Träger (36) mit ersten und zweiten Enden;

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b) ein festes Medikament (12); und

c) Mittel zum Befestigen des Medikamentes an einem Ende des Trägers, so daß das Medikament (12) dieses Ende des Trägers im wesentlichen bedeckt, wobei die Befestigungsmittel Mittel zum Ausbilden von mehrfach ineinandergrifenden Bindungen zwischen dem Träger (36) und dem Medikament beinhalten, dadurch gekennzeichnet, daß die Mittel zum Ausbilden der mehrfach ineinandergrifenden Bindungen einen Rahmen an einem Ende des Trägers (36) beinhalten mit einer Vielzahl von Öffnungen (16) darin, um die Abtrennung des Medikamentes von dem Träger zu verhindern und um ein Abbrechen großer Stücke des Medikamentes von dem Träger während dessen oraler Verabreichung zu verhindern.

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2. Vorrichtung nach Anspruch 1, bei der der Rahmen (14') wenigstens einen Hohlraum (15) darin aufweist, wobei die Vielzahl der Öffnungen (16) in der Oberfläche davon mit dem Hohlraum (15) in Verbindung steht zur Befestigung des Medikamentes (12) an dem Träger.

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3. Vorrichtung nach Anspruch 1, bei der der Rahmen eine Vielzahl abgeflachter Scheiben (45), voneinander entlang dem einen Ende des Trägers in Abständen verteilt, umfaßt, wobei die Vielzahl der Öffnungen (46) darin die ineinandergrifenden Bindungen mit dem Medikament bilden.

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4. Vorrichtung nach Anspruch 1, bei der der Rahmen eine Reihe von gekrümmten Rippenelementen (36) umfaßt, die um ein Ende des Trägers herum in Abständen verteilt sind, derart, daß die gekrümmten Rippenelemente die Vielzahl der Öffnungen begrenzen, um die ineinandergrifenden Bindun-

gen mit dem Medikament (12) auszubilden.

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5. Vorrichtung nach Anspruch 1, bei der der Rahmen ein Spiralgewindeelement (58) umfaßt, welches um ein Ende des Trägers herum ausgebildet ist, wobei das Spiralgewindeelement eine Vielzahl von Öffnungen (59) darin beinhaltet, um die ineinandergrifenden Bindungen mit dem Medikament (12) auszubilden.

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6. Vorrichtung nach Anspruch 1, welche weiterhin einen abnehmbaren Schutz (40) zum Vermeiden eines unbeabsichtigten Schluckens des Trägers (36) umfaßt, umlassend ein Teil mit einem Schlitz (41) darin zur verschiebbaren Befestigung an dem Träger sowie Mittel auf dem Träger zur verschiebbaren Anbringung des Schutzes daran, umfassend Mittel (37, 39) zum Ineinandergreifen mit dem Schlitz.

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7. Vorrichtung nach Anspruch 6, bei der der Schlitz ein Paar gegenüberliegender Laschen beinhaltet, die sich in nur einer Richtung biegen.

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8. Vorrichtung nach Anspruch 6, bei der die ineinandergrifenden Mittel auf dem Träger ein konisches Element (37') nächst eines Schildes umfassen, wobei die Laschen auf dem Schutz (40) dazu ausgebildet sind, um sich zu biegen und um es dem Schutz (40) zu ermöglichen, über das konische Element (37') zu gleiten und in einer Position gegen das Schild (39) zu verriegeln.

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9. Vorrichtung nach Anspruch 6, bei der die ineinandergrifenden Mittel auf dem Träger ein flexibles konisches Element (37) nächst eines Schildes umfassen, wobei der Schutz (40) dazu ausgebildet ist, um über das konische Element (37) zu gleiten und in einer Position gegen das Schild (39) zu verriegeln.

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**Revendications**

1. Dispositif pour l'administration orale d'un médicament solide, comprenant :

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a) un support allongé (36) ayant des première et seconde extrémités,

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b) un médicament solide (12); et

c) un moyen pour fixer ledit médicament à une extrémité dudit support de sorte que ledit médicament (12) recouvre pratiquement ladite extrémité dudit support (36), ledit moyen de fixation comportant un moyen pour former des liens multiples d'enclenchement entre ledit support (36) et ledit médicament,

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caractérisé en ce que ledit moyen pour former des liens multiples d'enclenchement comprend un cadre sur ladite extrémité dudit

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support (36) ayant une multitude d'orifices (16) pour éviter que ledit médicament (12) ne se sépare dudit support et pour empêcher que des gros morceaux dudit médicament ne s'échappent dudit support pendant son administration orale.

2. Dispositif selon la revendication 1, caractérisé en ce que ledit cadre (14') comprend au moins une cavité (15), la multitude d'orifices (16) ménagés dans sa surface communiquant avec ladite cavité (15) pour fixer ledit médicament (12) audit support (36).

3. Dispositif selon la revendication 1, caractérisé en ce que ledit cadre comprend une multitude de disques aplatis (45) espacés les uns des autres suivant ladite extrémité dudit support (10), la multitude d'orifices (46) qu'il comporte servant à former lesdits liens d'enclenchement avec ledit médicament (12).

4. Dispositif selon la revendication 1, caractérisé en ce que ledit cadre comprend une série d'éléments de nervure incurvés (56) espacés les uns des autres autour de ladite extrémité dudit support (36) de sorte que lesdits éléments de nervure incurvés définissent ladite multitude d'orifices pour former lesdits liens d'enclenchement avec ledit médicament (12).

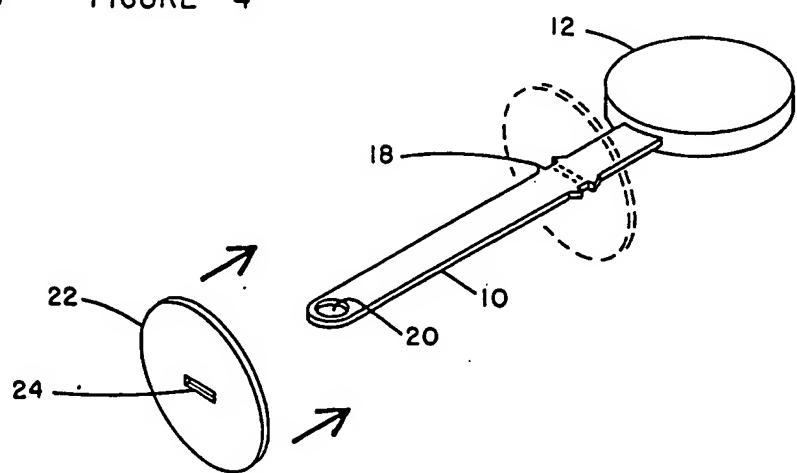
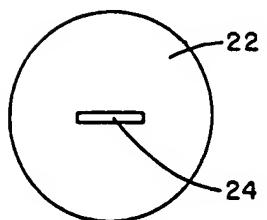
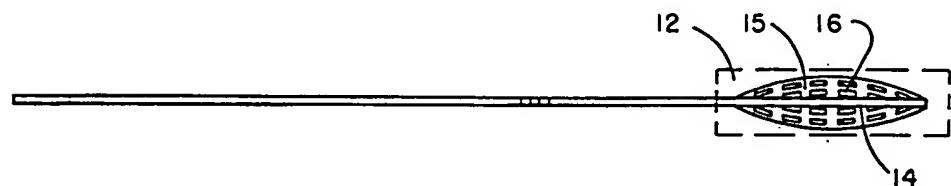
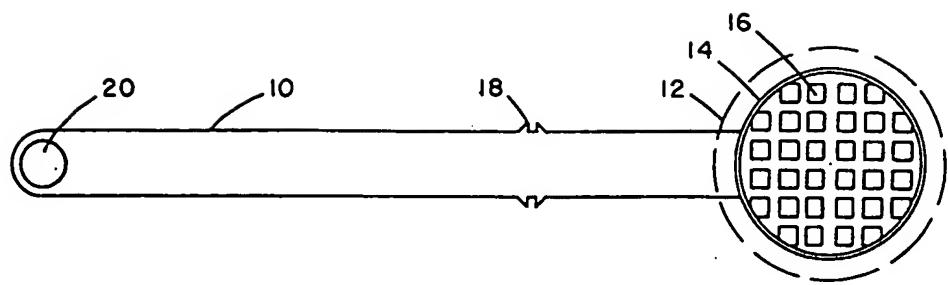
5. Dispositif selon la revendication 1, caractérisé en ce que ledit cadre comprend un élément enroulé en spirale (58) qui est formé autour de ladite extrémité dudit support (36), ledit élément enroulé en spirale comportant une multitude d'orifices (59) pour former lesdits liens d'enclenchement avec ledit médicament (12).

6. Dispositif selon la revendication 1, comprenant en outre un protecteur de sécurité détachable (40) afin d'éviter l'avaléation par inadvertance dudit support (36) comportant un élément ayant une fente (41) pour un assujettissement coulissant audit support et un moyen sur ledit support pour y fixer de manière coulissante ledit protecteur de sécurité comprenant un moyen (37, 39) pour enclenchement dans ladite fente.

7. Dispositif selon la revendication 6, caractérisé en ce que ladite fente comprend une paire de pattes opposées (49) qui ne fléchissent que dans une direction.

8. Dispositif selon la revendication 6, caractérisé en ce que ledit moyen d'enclenchement sur ledit support comprend un élément conique (37') contigu à un écran (39), lesdites pattes dudit protecteur de sécurité (40) étant destinées à fléchir et à permettre audit protecteur de sécurité de coulisser sur ledit élément conique (37') et de se bloquer en position contre ledit écran (39).

9. Dispositif selon la revendication 6, caractérisé en ce que ledit moyen d'enclenchement sur ledit support comporte un élément conique flexible (37) contigu à un écran (39), ledit protecteur de sécurité (40) étant destiné à coulisser sur ledit élément conique (37) et à se bloquer en position contre ledit écran (39).



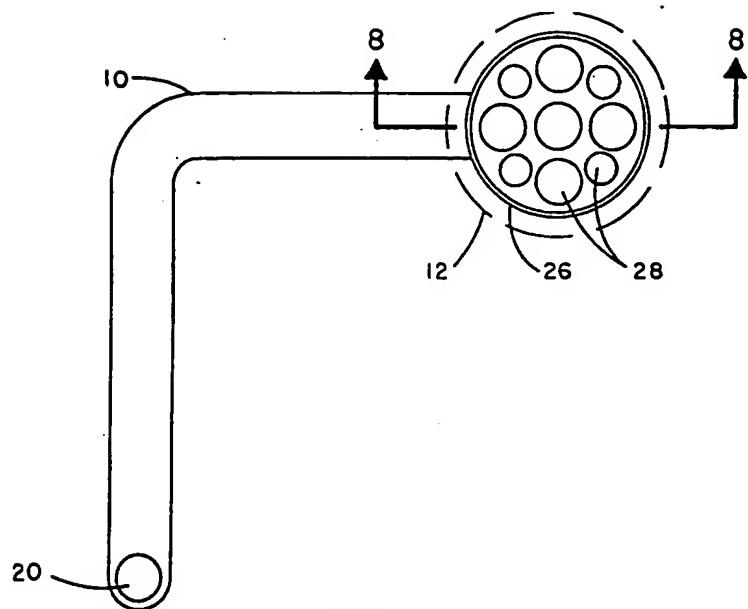


FIGURE 6

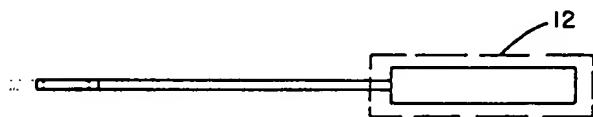


FIGURE 7

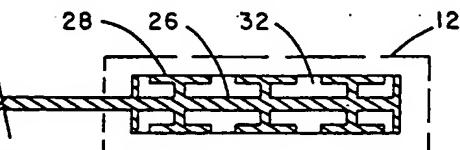


FIGURE 8

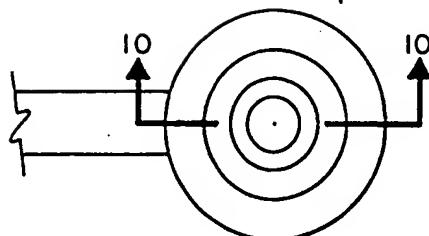


FIGURE 9

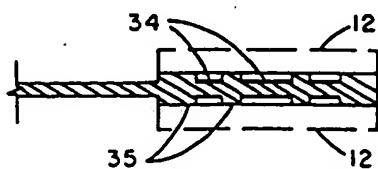


FIGURE 10

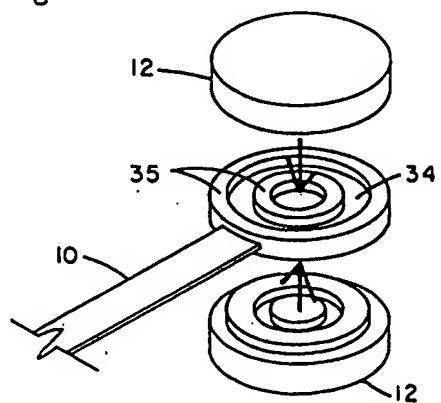


FIGURE 11

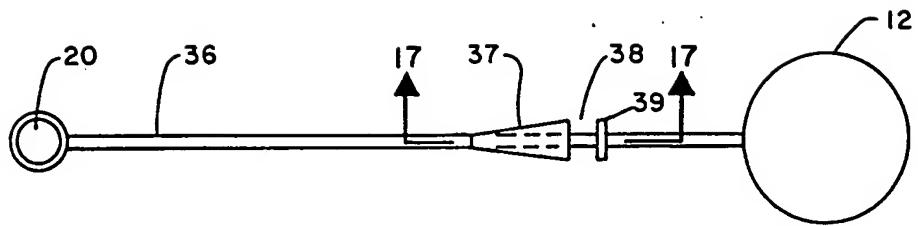


FIGURE 12

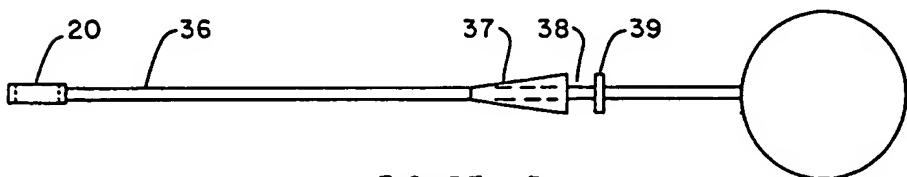


FIGURE 13

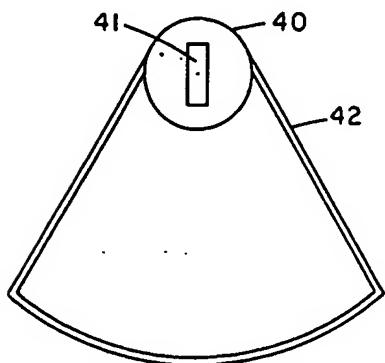


FIGURE 14

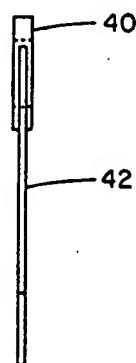


FIGURE 15

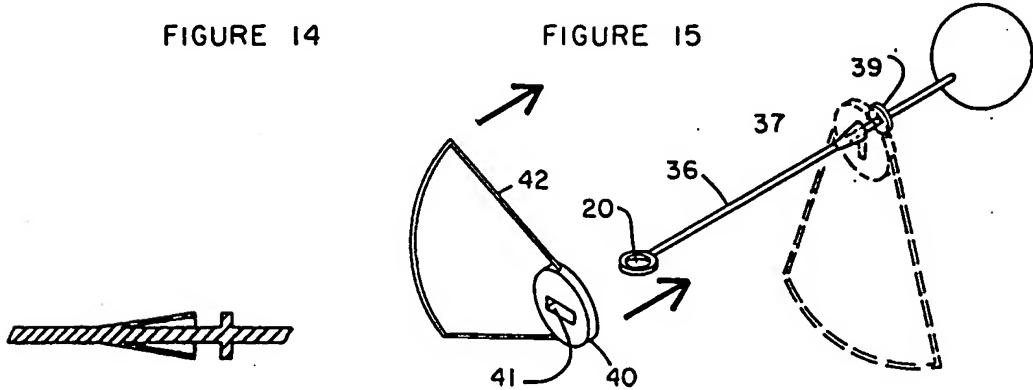


FIGURE 16



FIGURE 17

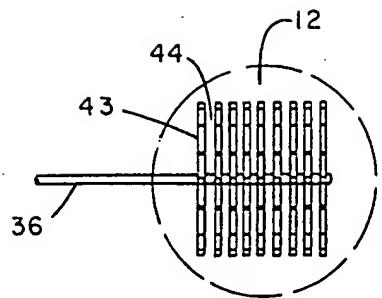


FIGURE 18

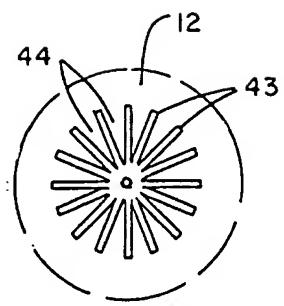


FIGURE 19

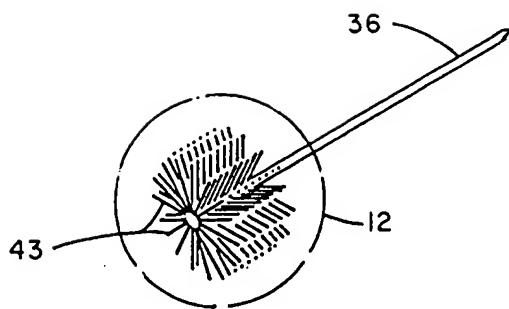


FIGURE 20

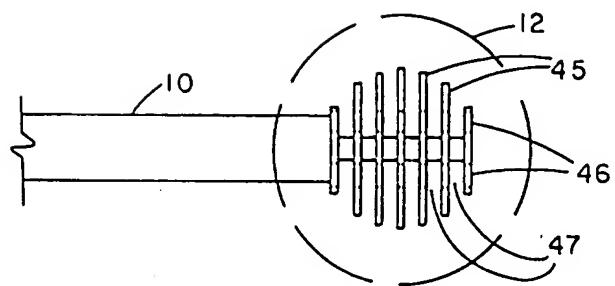


FIGURE 21

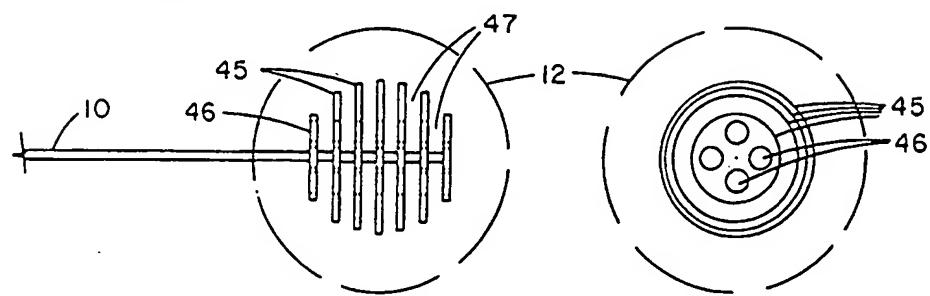


FIGURE 22

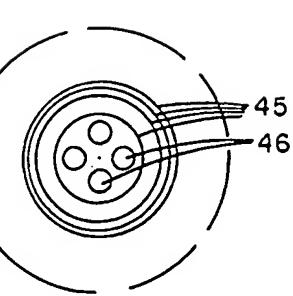


FIGURE 23

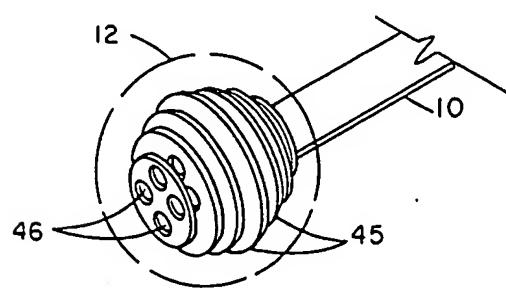


FIGURE 24

FIG. 25

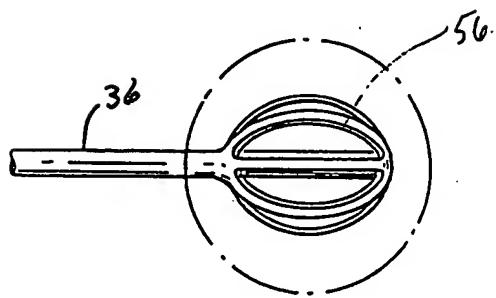


FIG. 26

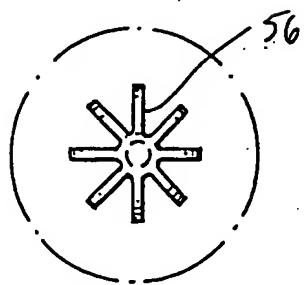


FIG. 27

